FLM-1

6/12 Port Fiber-Optic Multiplexer
Installation and Operation Manual

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Warranty

This RAD product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, RAD will, at its option, either repair or replace products which prove to be defective. For warranty service or repair, this product must be returned to a service facility designated by RAD. Buyer shall prepay shipping charges to RAD and RAD shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties and taxes for products returned to RAD from another country.

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The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied firmware or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

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The remedies provided herein are the Buyer's sole and exclusive remedies. RAD shall not be liable for any direct, indirect special, incidental, or consequential damages, whether based on contract, tort, or any legal theory.

Regulatory Information

FCC-15 User Information

This equipment has been tested and found to comply with the limits of the Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to the radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Warning per EN 55022

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

Safety Warnings

The exclamation point within a triangle is intended to warn the operator or service personnel of operation and maintenance factors relating to the product and its operating environment which could pose a safety hazard.

Always observe standard safety precautions during installation, operation and maintenance of this product. Only a qualified and authorized service personnel should carry out adjustment, maintenance or repairs to this instrument. No adjustment, maintenance or repairs should be performed by either the operator or the user.

Telecommunication Safety

The safety status of each of the ports on the FLM-1 is declared according to EN 41003 and is detailed in the table below:

Ports	**Safety Status**	
DTE	SELV	Circuit operating with Safety Extra-Low Voltage
4W	TNV-1	Circuit whose normal operating voltage does not exceed the limits of SELV, but is subject to overvoltages from Telecommunications Networks.

Declaration of Conformity

Manufacturer's Name: RAD Data Communications Ltd.

Manufacturer's Address: 24 Raoul Wallenberg St.
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Israel

declares that the product:

Product Name: **FLM-1**

Conforms to the following standard(s) or other normative document(s):

EMC: EN 55022 (1994) Limits and methods of measurement of radio disturbance characteristics of information technology equipment.

EN 50082-1 (1992) Electromagnetic compatibility - Generic immunity standards for residential, commercial and light industry.

Safety: EN 60950 (1992/93) Safety of information technology equipment, including electrical business equipment.

Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC. The product was tested in a typical configuration.

Tel Aviv, October 29th, 1996

Haim Karshen
VP Quality

European Contact: RAD Data Communications GmbH, Berner Strasse 77, 60437 Frankfurt am Main, Germany

Contents

CHAPTER 1 INTRODUCTION

1.1 Overview 1-1
- General 1-1
- Versions 1-1
- Applications 1-1

1.2 Physical Description 1-3
- Front Panel 1-4
- Rear Panel 1-4

1.3 Functional Description 1-4

1.4 Technical Specifications 1-5
- Subchannels 1-5
- Main Channel 1-5
- Diagnostics 1-6
- Power 1-7
- Physical 1-7
- Environment 1-7

CHAPTER 2 INSTALLATION AND SETUP

2.1 Introduction 2-1

2.2 Site Requirements and Prerequisites 2-1

2.3 Package Contents 2-1

2.4 Installation and Setup 2-2
- Setting the Internal Jumpers 2-2
- Connecting the Interfaces 2-3
- Connecting the Subchannels 2-4
- Connecting the Power 2-7

CHAPTER 3 OPERATING INSTRUCTIONS

3.1 General 3-1

3.2 Front Panel Indicators and Switches 3-1

3.3 Operating Instructions 3-2
- Power Turn-On 3-2
- Operation 3-2
- Power Turn-Off 3-2
- Operational Field Strapping Changes 3-2

CHAPTER 4 TROUBLESHOOTING AND DIAGNOSTICS

4.1 Frequently Asked Question 4-1

4.2 Diagnostics Tests 4-1

Local Loopback 4-2

Remote Loopback 4-2

4.3 Fault Isolation and Troubleshooting 4-2

APPENDIX A PIN ASSIGNMENT FOR SUBCHANNELS WITH DB-25 CONNECTORS

APPENDIX B PINOUT FOR RJ-45 CONNECTORS

List of Figures

Figure 1-1 Typical Point-to-Point Application 1-2
Figure 1-2 Typical Ring Installation 1-2
Figure 1-3 FLM-1 3D View 1-3

Figure 2-1 Strapping Diagram 2-3
Figure 2-2 FLM-1/4W Rear Panel with a Terminal Block Main Link Connector 2-3
Figure 2-3 FLM-1/4W Rear Panel with an RJ-45 Main Link Connector 2-3
Figure 2-4 FLM-1/DF Rear Panel with a DF Main Link Connector 2-3
Figure 2-5 FLM-1/4W Rear Panel with RJ-45 Main Link and Subchannel Connectors 2-4
Figure 2-6 FLM-1/DF Rear Panel with STA Main Link and RJ-45 Subchannel Connectors 2-4
Figure 2-7 FLM-1/4W Rear Panel with Main Link Terminal Block and RJ-45 Subchannel Connectors 2-4
Figure 2-8 Connecting Channel Doubler to an FLM-1 Subchannel for 12 Channel Operation 2-5
Figure 2-9 Suggested Connection for Transmitting DTR to DSR Control Signals End-to-End (DB-25 Connectors) 2-5
Figure 2-10 Suggested Connection for Transmitting RTS to DCD Control Signals End-to-end (DB-25 Connectors) 2-5
Figure 2-11 Suggested Connection for Transmitting DTR to DSR Control Signals End-to-End (RJ-45 Connectors) 2-6
Figure 2-12 Suggested Connection for Transmitting RTS to DCD Control Signals End-to-end (RJ-45 Connectors) 2-6

Figure 3-1 FLM-1 Front Panel 3-1

List of Tables

Table 1-1 Distortion and Number of Sites for FLM-1 in Ring Application 1-3
Table 1-2 Performance in Various Modes of Operation 1-4

Table 3-1 FLM-1 Indicators and Switches 3-2

Table 4-1 Fault Isolation and Troubleshooting 4-3

Chapter 1
Introduction

1.1 Overview

General

FLM-1 is a full duplex time division asynchronous multiplexer enabling up to twelve async terminals to be multiplexed onto a single channel. FLM-1 is intended for use in manufacturing facilities, building complexes, campuses and other similar point-to-point and ring applications.

Versions

One of the following media options for the main channel interface is available with the unit:

- Electrical option (FLM-1/4W): 4-wire for transmission over two twisted pairs (terminal block or RJ-45 connector)
- Optical option (FLM-1/DF): Dual fiber for transmission over dual fiber-optic cable.

Secondary channels are represented by six DB-25 connectors or 12 RJ-45 connectors. For detailed information about main and secondary channel options *see Section 1-4, "Technical Specifications"* and *Connecting the Interfaces in Section 2-5*.

Applications

Point-to-Point Application

FLM-1 is used mainly for point-to-point configurations where distances of up to several kilometers are involved. *Figure 1-1* shows a typical application where a cluster of terminals is connected to a host computer through a single link.

Maximum data rate on each FLM-1 subchannel is 19.2 kbps for the 4-wire version and 38.4 kbps for the dual-fiber version, with 12.5% distortion when working with 6 data channels and 25% distortion when working with 12 data channels or 6 data + 6 control channels.

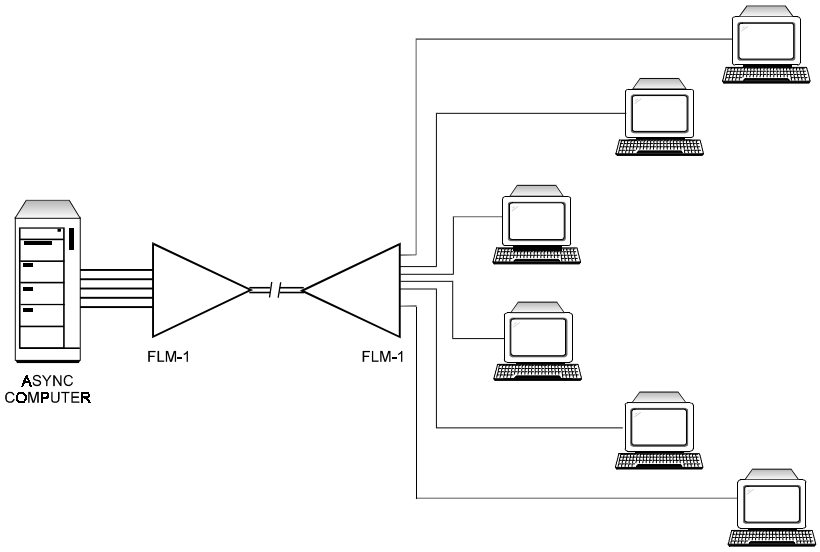

Figure 1-1 Typical Point-to-Point Application

Ring Application

For installations involving clusters of terminals distributed in several locations, FLM-1 units may be installed in a ring-type configuration, as shown in *Figure 1-2*.

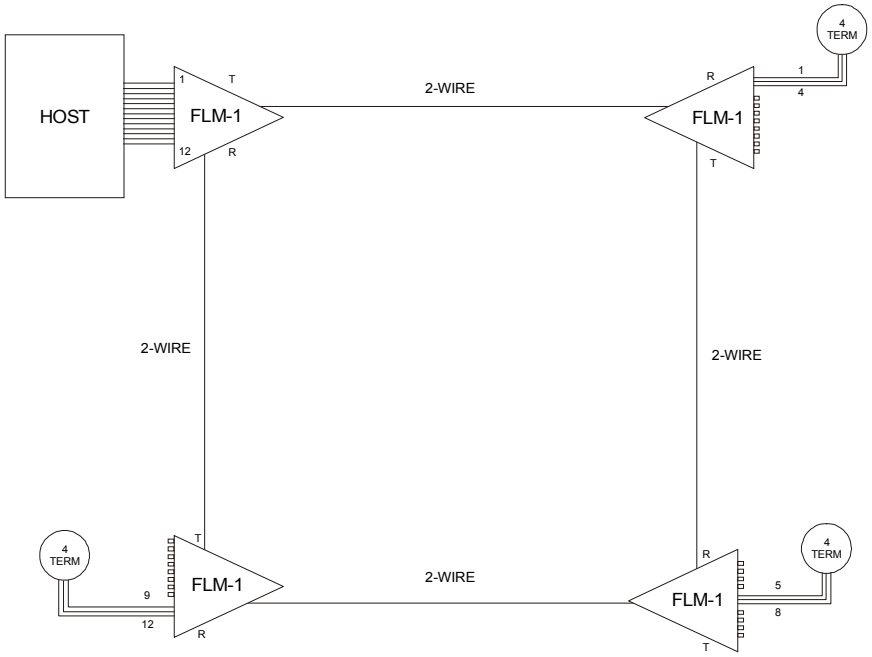

Figure 1-2 Typical Ring Installation

Note *In this application, the unconnected channels at each site must be bypassed by shorting Pins 2 and 3 of the relevant subchannel connector.*

Table 1-1 shows distortion per node and maximum number of nodes/sites allowed for different data rates on each subchannel, for the 4-wire and the dual-fiber versions.

Table 1-1 Distortion and Number of Sites for FLM-1 in Ring Application

Data Rate (kbps)	Distortion per Node (%)		Number of Nodes/Sites	
	4 wire	Fiber	4 wire	Fiber
19.2	25.00	12.50	2	4
9.6	12.50	6.250	3	4
4.8	6.250	3.125	4	8
2.4	3.125	1.5625	8	16
1.2	1.5625	0.78125	16	32

1.2 Physical Description

A 3D view of FLM-1 is shown in *Figure 1-3*.

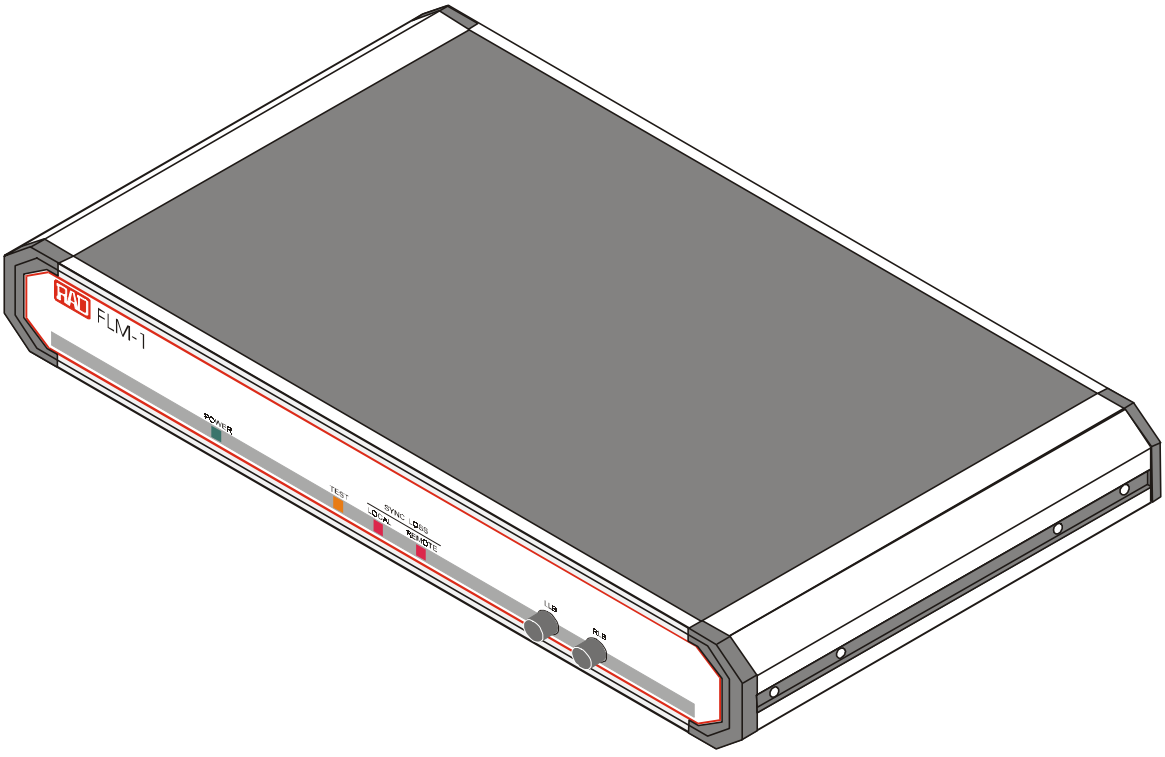

Figure 1-3 FLM-1 3D View

Front Panel

The front panel provides control over the operation of the unit. The LEDs provide real-time indications related to the operation and status of the unit. Two push-button switches allow test loopbacks for the FLM-1 diagnostics. For details, *see Chapter 3, "Operation" and Chapter 4, "Troubleshooting and Diagnostics"*.

Rear Panel

The rear panel of the unit allows access to interface and power connections. For details, *see Chapter 2, "Installation"*.

1.3 Functional Description

FLM-1 can operate in two operation modes: set to 6 or 12 channels, which is controlled by a user-selectable strap. When the unit is set for six channels, each channel can be used to transmit full duplex data end-to-end. When the unit is set for twelve channels, each subchannel can be used for either data or control signal transmission, according to the specific application. For example:

- All twelve channels can be used to transmit full duplex data end-to-end.

Note *In the case of DB-25 connectors version, this mode requires a channel doubler cable (see Section 2.4 for details).*

- Six channels can be used to transmit full duplex data and six can be used to transmit control signals end-to-end.

Note *This operation mode requires a channel doubler of another type. This channel double would be different for different types of subchannel connectors (DB-25 or RJ-45) and different types of control signal. For more information see Connecting the Interface in Section 2-5.*

Multiplexing is implemented by using an over-sampling technique. Each of the twelve channels is sampled at 78.6 kbps for the electrical (4-wire) option or at 157.2 kbps for the optical (fiber) option.

Table 1-2 summarizes the FLM-1 performance with various options and modes of operation.

Table 1-2 Performance in Various Modes of Operation

No. of Subchannels in Use	Max Data Rate (kbps)	Distortion (%)	
		4 Wire	Fiber
6	19.2	12.5	6.25
6	38.4	-	12.5
12	19.2	25.0	12.5
12	38.4	-	25.0

Note

1. The distortion refers to the duty cycle and not to the voltage level.

*2. Whenever possible (if the number of channels is less than or equal to 6**)** it is recommended to operate FLM-1 in the six-channel mode, which results in less distortion.*

1.4 Technical Specifications

Subchannels

Transmission format	Asynchronous
Data rate	Optical interface: up to 38.4 kbps
	Electrical interface: up to 19.2 kbps
Distortion	*See Table 1-2*
Interface	RS-232/V.24
Number of subchannels	Up to six or up to twelve, depending on the version and availability of a channel doubler (*see Section 2.4*)
Connectors	Six D-type 25-pin, female, or twelve RJ-45
Mode of operation	Full-duplex

Main Channel

Electrical Interface

Transmission line	4-wire unconditioned telephone lines (two twisted pairs)
Operating range	Maximum of 1.6 km (1 mile) on 22 AWG cable
Data rate	1.2288 Mbps
Output format	Balanced, transformer isolated, 6V peak-to-peak (on 100Ω)
Input resistance	100Ω
Connector	Terminal block or RJ-45

Optical Interface

Transmission line	Double optical cable
Operating range	
for 850 nm:	up to 5 km (3.1 miles)
for 1300 nm:	up to 40 km (25 miles) with attenuation of of 0.5 dB/km with 9/125µ fiber optic cable
Data rate	2.4576 Mbps
Operating wavelength	850 nm or 1300 nm
Optical output level	
for 850 nm:	-24 dBm min into 50/125 fiber -20 dBm min into 62.5/125 fiber
for 1300 nm:	-18 dBm min into 9/125 fiber
Receiver sensitivity	-40 dBm min
Dynamic range	24 dB
Connectors	Standard SMA or ST connectors

Diagnostics

In compliance with ITU V.54

Local digital loopback	Activated by the LLB push button
Remote digital loopback	Activated by the RLB push button

Switches and Indicators

POWER LED (Green)	ON when the unit is powered
TEST LED (Yellow)	ON when the local or remote unit is performing a loopback
LOCAL SYNC LOSS LED (Red)	ON when synchronization is lost at the local unit
REMOTE SYNC LOSS LED (Red)	ON when synchronization is lost at the remote unit
LLB Switch	When pressed, the unit is performing local loopback
RLB Switch	When pressed, the unit is performing remote loopback

Power	100/115/230 VAC (± 10%), 50-60 Hz, 7.5 VA Max	
Physical	*Height*	4.4 cm / 1.72 in (1U)
	Width	33.8 cm / 13.30 in
	Depth	22.0 cm / 8.60 in
	Weight	1.6 kg / 3.50 lb
Environment	*Temperature*	0-50°C / 32-122°F
	Humidity	Up to 90%, non-condensing

Chapter 2
Installation and Setup

2.1 Introduction

This chapter provides instructions for mechanical and electrical installation of FLM-1.

Sections 2.2 and 2.3 describe site preparation for installation of FLM-1.

Section 2.4 describes mechanical and electrical installation, including strap selection, setting the internal jumpers, connecting the main link and subchannel interfaces and connecting the power.

After completing installation, refer to Chapter 3 for operating information and system checkout to ensure proper operation.

2.2 Site Requirements and Prerequisites

Install FLM-1 within 1.5m (5 ft) of an easily accessible grounded AC outlet. The outlet should be capable of furnishing the voltage in accordance with the rated voltage of the unit.

Allow at least 90 cm (36 in) of frontal clearance for operating and maintenance accessibility. Allow at least 10 cm (4 in) clearance at the rear of the unit for signal lines and interface cables.

2.3 Package Contents

The FLM-1 package includes the following items:

- The FLM-1 unit
- The FLM-1 Installation and Operation Manual
- The AC power cord.

2.4 Installation and Setup

The FLM-1 units are delivered completely assembled. The units are designed for desktop installation or mounting in a 19-inch rack. Installation procedures for the FLM-1 unit are provided in the following paragraphs. For rack installation of FLM-1, refer to the *Rack Mounting Kit for 19-inch Racks* guide that comes with the RM kit.

To complete the installation of FLM-1, you must perform the following (in the given order):

- Determine the required configuration of FLM-1, according to your application, and set the internal jumpers accordingly.
- Connect the subchannel and main link interfaces.
- Connect power to the unit.

Setting the Internal Jumpers

Before connecting the interfaces and power to the unit, determine the required configuration of FLM-1 and position the straps accordingly. To do this, proceed as follows:

Warning

Access to the inside of the equipment is permitted only to authorized and qualified service personnel.

To avoid accidental electric shock, always disconnect the power cord before removing the unit from its casing.

1. Unscrew the upper cover screw located at the back of the unit.
2. Slide the rear drawer out.
3. Locate the strap marked “SELECT 6 OR 12 CHANNELS” on the circuit board. For up to 6 channels with no control applications, place the strap to 6. For any other application, place the strap to 12 (see *Figure 2-1*).
4. Locate the strap marked GND. According to your requirements, set the signal ground to be connected to shielding (chassis) ground or floating (NC). The factory setting is GND connected to Chassis ground. This setting is strongly recommended unless it is absolutely necessary to do otherwise.
5. Slide the rear drawer back to its place.
6. Fasten the upper cover screw at the back of the unit.

Caution

The safety status of the 4W port is TNV-1, operating within the limits of SELV. If the 4W network does not fulfill this requirement, the signal ground must be connected to the chassis ground.

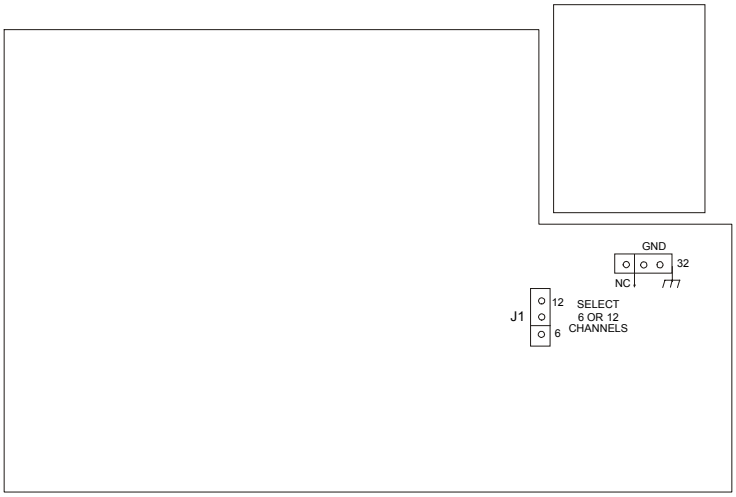

Figure 2-1 Strapping Diagram

Connecting the Interfaces

Figure 2-2 to *Figure 2-7* show the FLM-1 rear panel in all its versions, containing different main link and subchannel connectors.

Figure 2-2 to *Figure 2-4* show the FLM-1 versions with DB-25 subchannel connectors and different main link connectors: terminal block, RJ-45, and dual fiber.

Figure 2-5 to *Figure 2-7* show the FLM-1 versions with RJ-45 subchannel connectors and different main link connectors: terminal block, RJ-45, and dual fiber.

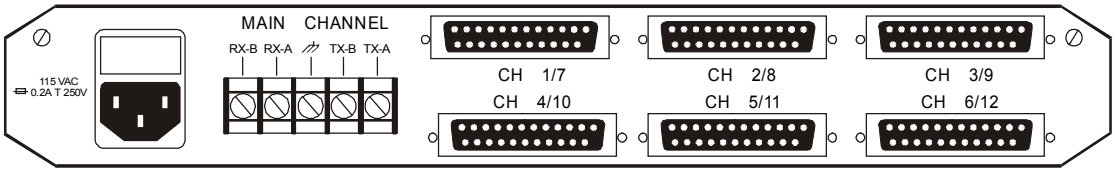

Figure 2-2 FLM-1/4W Rear Panel with a Terminal Block Main Link Connector

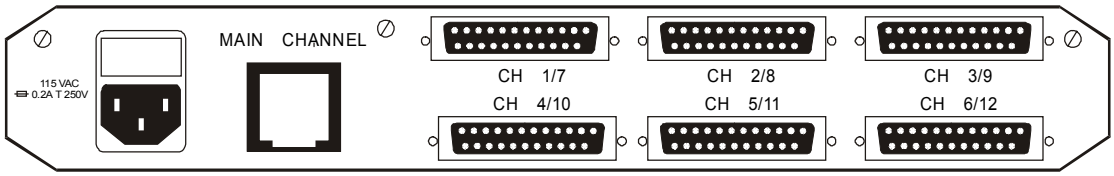

Figure 2-3 FLM-1/4W Rear Panel with an RJ-45 Main Link Connector

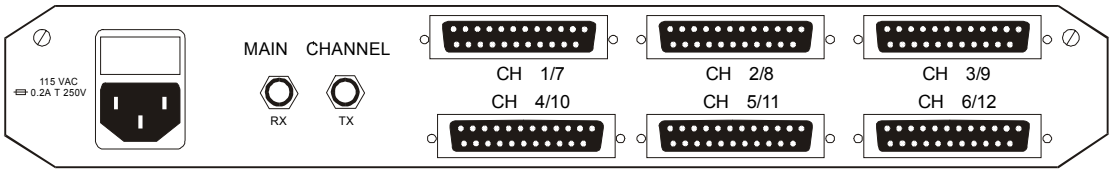

Figure 2-4 FLM-1/DF Rear Panel with a DF Main Link Connector

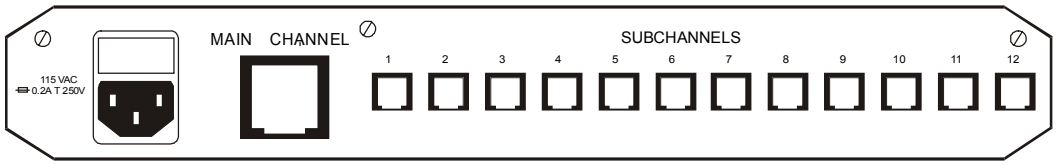

Figure 2-5 FLM-1/4W Rear Panel with RJ-45 Main Link and Subchannel Connectors

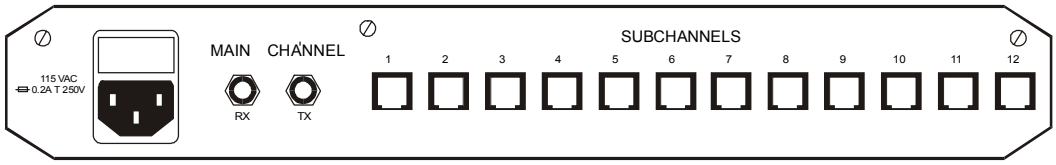

Figure 2-6 FLM-1/DF Rear Panel with STA Main Link and RJ-45 Subchannel Connectors

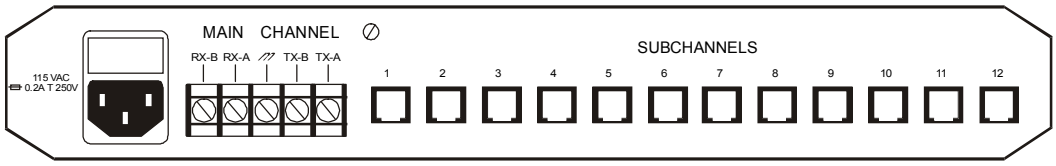

Figure 2-7 FLM-1/4W Rear Panel with Main Link Terminal Block and RJ-45 Subchannel Connectors

Connecting the Subchannels

DB-25 Connectors

In this version, six D-type 25-pin female connectors on the rear panel (see *Figures 2-2 to 2-4*) enable connection to the unit. Detailed information about the signals present at these connectors is given in Appendix A.

To have FLM-1 operating in a 6-channel mode, use standard cables with DB-25 male connectors.

To have FLM-1 operating in a 12-channel mode, use channel doubler cables (CD). You can order these cables from RAD or make them yourself according to pinout shown in *Figure 2-8* below.

To have FLM-1 operating in a 6-channel operation with full duplex data and control signals transmitted end-to-end, you have to make special cables (not provided by RAD). *Figure 2-9* shows suggested pin connections for transmitting a DTR-to-DSR control signal and *Figure 2-10* those for transmitting an RTS-to-DCD control signal.

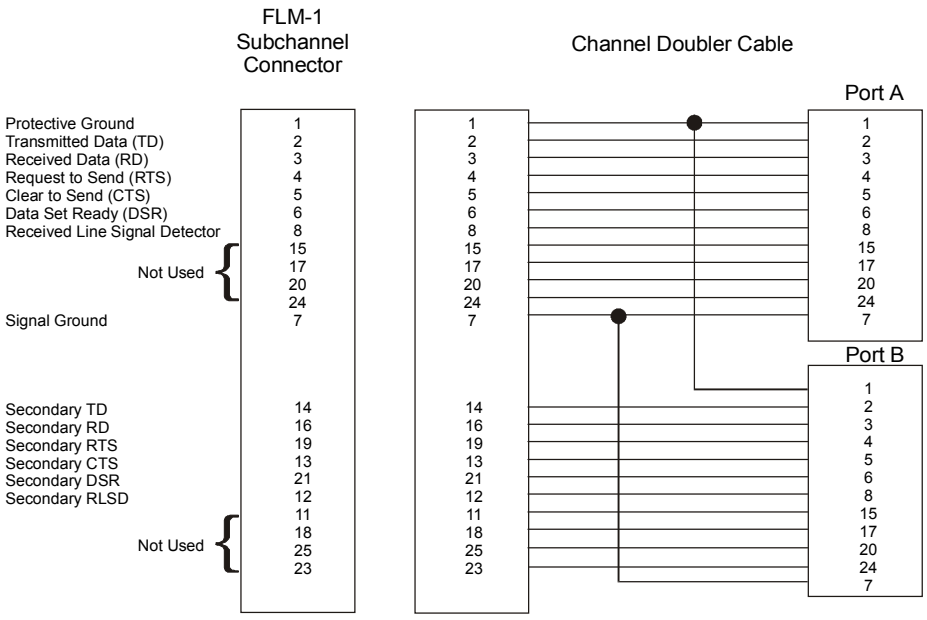

Figure 2-8 Connecting Channel Doubler to an FLM-1 Subchannel for 12 Channel Operation

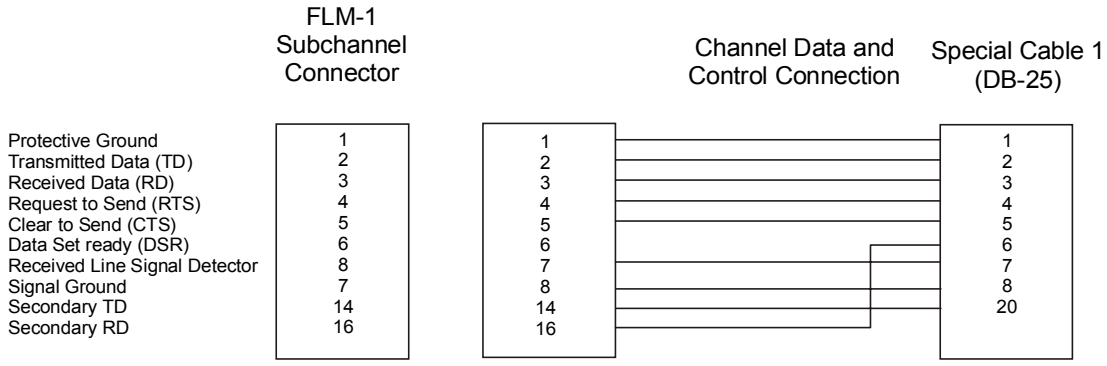

Figure 2-9 Suggested Connection for Transmitting DTR to DSR Control Signals End-to-End (DB-25 Connectors)

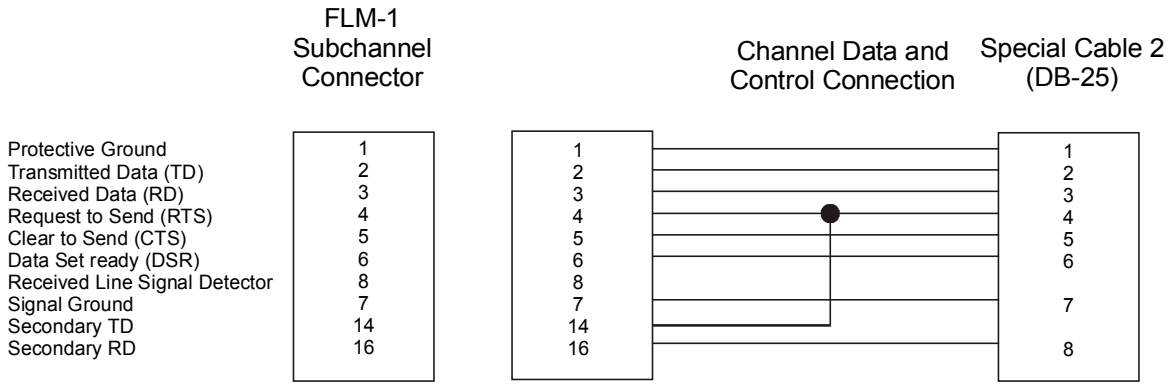

Figure 2-10 Suggested Connection for Transmitting RTS to DCD Control Signals End-to-end (DB-25 Connectors)

RJ-45 Connectors

Twelve RJ-45 modular jacks on the rear panel (*see Figures 2-5 to 2-7*) each support a single channel. Pinout for this option is given in Appendix B.

The six-channel operation with full duplex data and transmitting control signals end-to-end requires special cables (not provided by RAD). *Figure 2-11* shows suggested pin connections for transmitting a DTR-to-DSR control signal and *Figure 2-12* those for transmitting an RTS-to-DCD control signal.

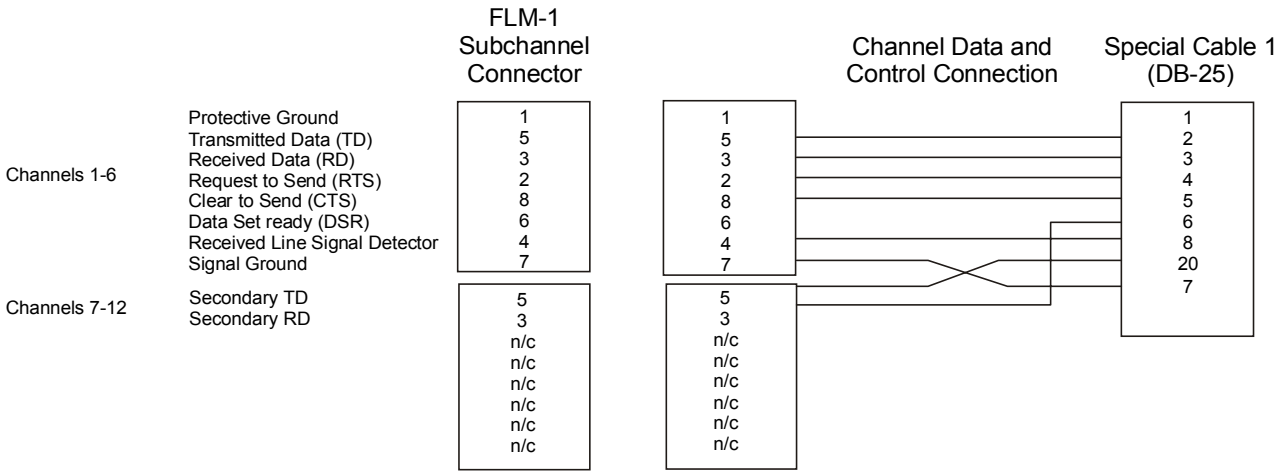
FLM-1 Subchannel Connector
Channel Data and Control Connection
Special Cable 1 (DB-25)
Channels 1-6
Protective Ground
Transmitted Data (TD)
Received Data (RD)
Request to Send (RTS)
Clear to Send (CTS)
Data Set ready (DSR)
Received Line Signal Detector
Signal Ground
Channels 7-12
Secondary TD
Secondary RD
1 5 3 2 8 6 4 7
5 3 n/c n/c n/c n/c n/c n/c
1 5 3 2 8 6 4 7
5 3 n/c n/c n/c n/c n/c n/c
1 2 3 4 5 6 8 20 7

Figure 2-11 Suggested Connection for Transmitting DTR to DSR Control Signals End-to-End (RJ-45 Connectors)

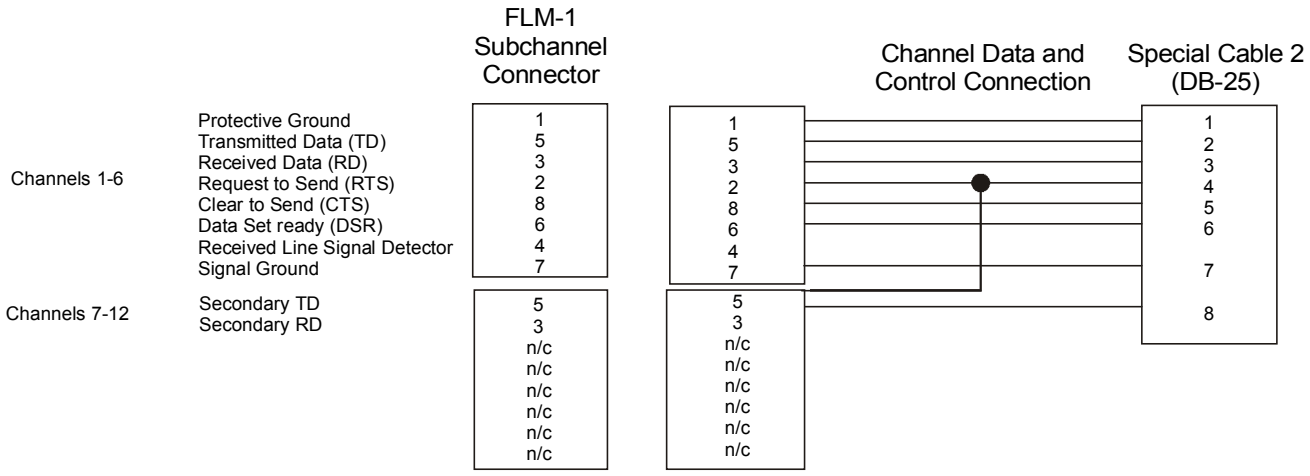
FLM-1 Subchannel Connector
Channel Data and Control Connection
Special Cable 2 (DB-25)
Channels 1-6
Protective Ground
Transmitted Data (TD)
Received Data (RD)
Request to Send (RTS)
Clear to Send (CTS)
Data Set ready (DSR)
Received Line Signal Detector
Signal Ground
Channels 7-12
Secondary TD
Secondary RD
1 5 3 2 8 6 4 7
5 3 n/c n/c n/c n/c n/c n/c
1 5 3 2 8 6 4 7
5 3 n/c n/c n/c n/c n/c n/c
1 2 3 4 5 6 7 8

Figure 2-12 Suggested Connection for Transmitting RTS to DCD Control Signals End-to-end (RJ-45 Connectors)

Connecting the Main Channel

4-wire Version - Terminal Block

A 5-screw terminal block is located at the rear panel (*see Figures 2-2 and 2-7*). Five wires, marked TX-A, TX-B, RX-A, RX-B and CHASSIS GND connect transmit and receive wires and the cable shield (if available).

To connect the main link with the terminal block, proceed as follows:

1. Connect TX connectors at the local unit to RX connectors at the opposite unit.
2. Connect RX connectors at the local unit to TX connectors at the opposite unit.
3. Connect the ground wires, if necessary.

4-Wire Version - RJ-45 Jack

Pinout for this version is given in *Appendix B*.

Dual-Fiber Version

Two SMA or ST connectors, marked TX and RX, are located on the rear panel. To connect the interface, proceed as follows:

1. Remove the protective caps from the connectors and keep them in a safe place for later use.
2. Clean both connectors to remove dust accumulated during shipment (using ethanol or a similar cleaning fluid).
3. Connect the transmit fiber to the TX connector and the receive fiber to the RX connector, and secure the fastening nuts.

At the remote unit, the transmit fiber must be connected to RX and the receive fiber to TX.

Caution *Do not overtighten the fiber-optic connectors.*

Connecting the Power

AC power is supplied to the FLM-1 through a 1.5 m (5 ft) cord terminated by a grounded 3-wire plug. The AC cord is fused at the rear panel AC power receptacle of the unit. A slow-blow fuse of 0.1A is required for 230 VAC operation, and a slow-blow 0.2A fuse for 115 VAC operation.

Warning

Before connecting power to the unit, verify that the socket outlet is provided with a protective earth contact. If you are using an extension cord (power cable) make sure it is grounded as well.

Interrupting the protective (grounding) conductor (inside or outside the unit), or disconnecting the protective earth terminal can make this unit dangerous.

Make sure that only fuses of the required rating, as marked on the rear panel, are used for replacement. Do not use repaired fuses or short-circuit the fuse holder. Always disconnect the mains cable before removing or replacing the fuse. Whenever it is likely that the fuse protection has been damaged, make the unit inoperative.

To connect power to FLM-1, simply insert its power cord into the power socket.

Chapter 3
Operating Instructions

3.1 General

This chapter covers:

- A list of controls and indicators together with their functions.
- An operating procedure covering power turn-on, operating instructions, and power turn-off.
- Information on strapping.

Before operating FLM-1, complete all the installation procedures described in *Chapter 2*.

3.2 Front Panel Indicators and Switches

The FLM-1 front panel is shown in *Figure 3-1*.

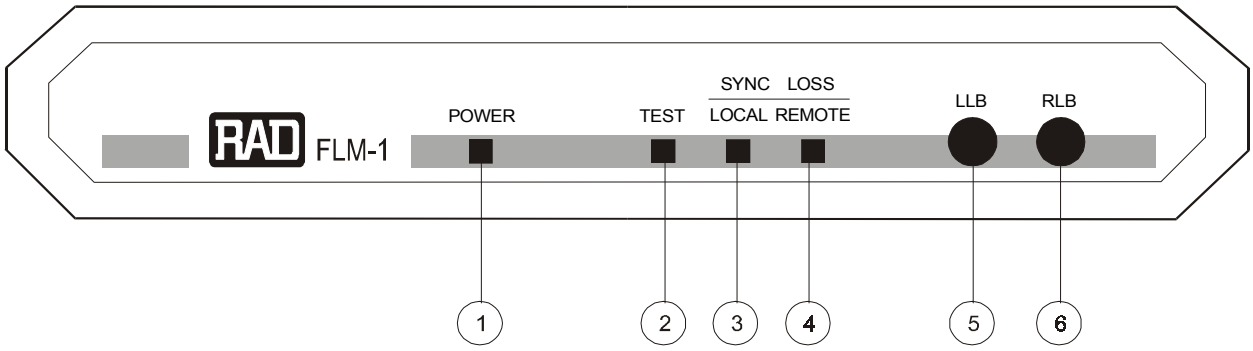

Figure 3-1 FLM-1 Front Panel

Table 3-1 lists the functions of the FLM-1 indicators and switches.

Table 3-1 FLM-1 Indicators and Switches

Identification No	Name	Type	Function
1	POWER	LED Indicator (green)	Lights up when the unit is powered.
2	TEST	LED Indicator (yellow)	Lights up when either local or remote unit is performing a loopback test.
3	SYNC LOSS - LOCAL	LED Indicator (red)	Lights up when synchronization is lost at the local unit.
4	SYNC LOSS - REMOTE	LED Indicator (red)	Lights up when synchronization is lost at the remote unit.
5	LLB	Push button	When pressed (pushed in), the unit performs a local loopback.
6	RLB	Push button	When pressed (pushed in), the unit performs a remote loopback.

Note *Pressing LLB and RLB simultaneously has no effect; the unit just continues to operate normally.*

3.3 Operating Instructions

Power Turn-On To apply AC power to FLM-1, connect its power cord to an acceptable AC source. The POWER LED should light up. If the local and remote FLM-1 units are in operation and properly connected via the main channel, no other indicator should be ON. If it is not so, refer to Chapter 4 for troubleshooting information.

Operation FLM-1 operates entirely unattended except when performing system tests.

Power Turn-Off To turn off FLM-1, simply remove the AC power cord from the AC source.

Operational Field Strapping Changes If it becomes necessary to reconfigure FLM-1 for twelve-channel mode or six-channel mode operation, follow the appropriate setup procedure described in *Section 2.4*.

Warning

Access to the inside of the equipment is permitted only to authorized and qualified service personnel.

Chapter 4

Troubleshooting and Diagnostics

4.1 Frequently Asked Question

Question: *How can I connect six pairs of DTEs for transferring Data and Control Signals (RTS to DCD) end-to-end?*

Answer: First set the jumper marked "SELECT 6 OR 12 CHANNELS" to the "12" position. Now FLM-1 passes 12 pairs of signals (TD and RD of channels 1 to 6 and secondary TD and RD of channels 7 to 12) end-to-end. All the other channel signals are local: they do not pass end-to-end, being transmitted between FLM-1 and the DTE (*see Table B-2*).

To transfer the control signals end-to-end, you must make a special cable. If you have a model with DB-25 subchannel connectors, for exact wiring *see Figure 2-10*; if your model has RJ-45 subchannel connectors, *see Figure 2-12*. This way you are using channel 1 to pass the data signals end to-end, and channel 7 (secondary channel) to pass the RTS and DCD signals end-to-end.

4.2 Diagnostics Tests

FLM-1 features ITU V.54 diagnostic capabilities for performing loopback tests. FLM-1 supports two types of loopback tests: a local loopback and remote loopback.

Note *Before you start to perform any of the loopback tests, set to OFF (negative voltage) the following signals at the remote unit subchannels:*
- Received Data (Circuit 104)
- Clear to Send (Circuit 106)
- Receive Line Signal Detector (Circuit 109)

Local Loopback

When FLM-1 performs a local loopback, the data from the local transmitter is looped back to the local receiver at the digital level, thus checking all local digital circuitry for proper operation.

To activate the test, press the LLB push button located on the front panel. If the local unit is operating properly, the yellow TEST indicator should light up and all other indicators should be OFF.

If the local and remote units are properly connected via the main channel, this test also checks the following:

- Local transmitter analog interface
- Remote analog section
- Digital receiver section.

In this case the yellow TEST indicator on the remote unit should also be lit up.

Remote Loopback

The remote loopback loops back data from the remote receiver to the remote transmitter, thus checking:

- All local digital circuitry
- Both local and remote analog interfaces
- Main channel link
- Remote digital receiver section.

To activate the test, press the RLB push button on the front panel. If both local and remote units operate properly, the yellow TEST indicators should be lit at both units and all other indicators should be OFF.

4.3 Fault Isolation and Troubleshooting

The symptoms and corresponding procedures listed in Table 4-1 will help you identify, isolate, and correct faults in accordance with the tools available.

Warning

These service instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

Table 4-1 Fault Isolation and Troubleshooting

Symptom	Action
All front panel indicators are OFF	1. Check that power is supplied to the unit. 2. Check the fuse inside the AC receptacle on the rear panel and replace it with a new one. 3. Replace the unit. The fault is probably in the unit's power supply circuits.
LOCAL SYNC LOSS LED is ON	1. Perform an LLB test as described in *Section 4-1*. The yellow TEST LED should light and LOCAL SYNC LOSS should go OFF. If this does not happen, replace the local unit. Otherwise proceed to step 2. 2. Perform an RLB test. The yellow TEST LED should light and LOCAL SYNC LOSS should go OFF. If this does not happen, replace the local unit. Otherwise proceed to step 3. 3. Perform steps 1 and 2 at the remote site. If the fault is still not located, replace both units one at a time. If the problem persists, the main channel link between the units is probably defective and should be checked.
REMOTE SYNC LOSS LED is ON	4. Perform an LLB test at the remote unit. The yellow TEST LED should light and LOCAL SYNC LOSS should go OFF. If this does not happen, replace the remote unit. Otherwise proceed to step 2. 5. Perform an RLB test at the remote unit. The yellow TEST LED should light and LOCAL SYNC LOSS should go OFF. If this does not happen, replace the remote unit. Otherwise proceed to step 3. 6. Perform steps 1 and 2 at the local site. If the fault is still not located, replace both units one at a time. If the problem persists, the main channel link between the units is probably defective and should be checked.

Appendix A

Pin Assignment for Subchannels with DB-25 Connectors

Table A-1 Pin Assignment for Subchannels with DB-25 Connectors

V.24	RS-232	Pin	Signal	Description
101	AA	1	Protective Ground	Chassis ground. May be isolated from signal ground (*see Section 2-4*).
102	AB	7	Signal Ground	Common signal and DC power supply ground.
103	BA	2 (14)	TD - Transmit Data	Serial digital data into FLM-1, end-to-end.
104	BB	3 (16)	RD - Receive Data	Serial digital data output from FLM-1, end-to-end.
105	CA	4 (19)	RTS - Request To Send	A positive level to FLM-1 when data transmission is desired, shorted to CTS.
106	CB	5 (13)	CTS - Clear To Send	A positive level from FLM-1 (if data transmission is possible), shorted to RTS.
107	CC	6 (21)	DSR - Data Set Ready	A positive DC voltage (+8V) from FLM-1 indicating that the unit is powered.
109	CF	8 (12)	DCD - Receive Line Signal Detector (Carrier Detect)	A positive level from FLM-1 except when either a sync loss occurs or remote loopback is performed.
–	–	9		This signal (+8V) is reserved for data set testing and for powering miniature modems
		10		This signal (-8V) is reserved for data set testing and for powering miniature modems

Note *Pin numbers in parentheses are for the secondary channel, available when using a channel doubler cable (working in 12-channel operation mode).*

Appendix B

Pinout for RJ-45 Connectors

The pinouts of the RJ-45 connectors for the FLM-1 line (main channel) and subchannels are given in *Tables B-1 and B-2*, respectively.

Table B-1 Main Channel Pinout

Pin	Signal
1	RX
2	RX
3	NC
4	NC
5	NC
6	NC
7	TX
8	TX

Table B-2 Subchannel Pinout

Pin	Signal	Note
1	V+	
2	RTS	Shorted to CTS
3	RXD	End-to-end, from FLM-1
4	DCD	According to main link sync status
5	TXD	End-to-end, into FLM-1
6	DSR	Always +8V
7	Signal GND	
8	CTS	Shorted to RTS